RESPONSE TO COMMENT 3

ADEQ COMMENT: *Section 5.4, Groundwater Quality*

In the course of monitoring, Excelsior detected petroleum odors in these and other coreholes, and free product in CS-10 and CS-14. Samples were collected as part of a study of Light Non-Aqueous Phase Liquids (LNAPLs) in groundwater by Haley & Aldrich (2015).

a. Please provide additional information regarding the lateral and vertical extent of the petroleum plume in the groundwater per A.A.C. R18-9-A202(A)(8)(b)(vi and vii).

b. Please provide additional information regarding your plan in addressing and determining the source of the petroleum contamination in the groundwater per A.A.C. R18-9-A202(A)(8)(b)(vi and vii).

c. Please provide additional information regarding the impact of mixing and injecting petroleum contaminated water to the aquifer per A.A.C. R18-9-A202(A)(8)(b)(vi and vii).

RESPONSE:

a. Excelsior does not have additional information regarding the lateral and vertical extent of the petroleum "plume". However, based on the chemical data presented in Table 5-5 of the APP Application and the Haley & Aldrich report (Appendix E of the APP application), a conceptual model is proposed in which there are two distinct sources of petroleum:

1. Drilling fluids, including diesel or some other petroleum product in CS-10 and CS-14. LNAPL, benzene, toluene, ethylbenzene, xylenes, and polycyclic aromatic hydrocarbons (PAHs) are present in these coreholes.
2. Gasoline compounds (primarily benzene, toluene, and 1,2 dichloroethane—a lead scavenger) from leaking underground storage tanks at "The Thing" (ADEQ LUST ID 4387). ADEQ closed the site in May 2005.

Regarding source #1, at CS-10 and CS-14, the most likely source of LNAPL and the hydrocarbon compounds detected in these coreholes is from the drilling fluids used to drill the borings. The following lines of evidence support this conclusion:

- Both of these coreholes were drilled in 1971. According to Ron Peterson (personal communication), a mud engineer at Halliburton, it was common practice at that time to add diesel or any inexpensive, available petroleum product to drilling mud to lubricate the drill rods and, if necessary, get them unstuck. As noted by Haley & Aldrich, the compounds detected in CS-10 and CS-14 are consistent with a mixture of petroleum products, including gasoline. Drilling mud technology has advanced significantly since that time, and the advanced polymers used now are more effective and environmentally friendly.

- LNAPL was not observed in any of the NSH wells drilled in 2014-2015, the nearest of which are 150 and 300 feet away (SHH-10, NSH-13, and NSH-14B).
- In February 2015, after LNAPL was discovered in CS-10 and CS-14, Haley and Aldrich returned to the site on a weekly basis to measure and bail LNAPL. They were able to remove all of the LNAPL from CS-14 and remove all but a very thin layer at CS-10. If a thick layer of LNAPL of significant lateral extent were present, LNAPL would continue to enter the hole and bailing would not have reduced the thickness.
- The extent of petroleum in CS-10 and CS-14 appears to be limited to the immediate area of the boreholes. The wells nearest to these borings (NSH-13 and NSH-9, respectively) do not contain LNAPL.
- There are no known prior site uses that would result in the LNAPL occurrence observed in these borings.

Regarding source #2, dissolved petroleum compounds have been detected in NSH-15, NSH-16, and NSH-17 in the southwest corner of the wellfield just downgradient of The Thing USTs. The wells are screened from depths ranging from 585 to 820 below ground surface (NSH-15), 580 to 820 below ground surface (NSH-16), and 940 to 1181 feet below ground surface (NSH-17). VOC concentrations are below AWQSs.

Toluene was detected in most of the NSH wells sampled in 2015. In most cases, toluene was the only compound detected. Detection of toluene in new monitor wells is common, and it is believed to be from the adhesive on the pipe wrap tape that was used on the pump and wiring (Christy's® Pipe Wrap Tape 10ml has 1.3% by weight toluene in the adhesive). Using toluene concentrations to evaluate the extent of a petroleum plume is not recommended for this reason. It is notable that the three wells that could not be pumped for very long before being dewatered, NSH-25, NSH-14b, and NSH-22, had some of the highest toluene concentrations. This supports the pipe wrap tape as a source—the well could not be adequately flushed. The other wells could be purged of significant volumes before samples were collected, so toluene concentrations were low to non-detect.

In summary, the extent of petroleum compounds in groundwater is limited to the southwest corner of the wellfield as a result of leaking underground storage tanks at The Thing, and in the immediate areas of CS-10 and CS-14, as a result of past drilling practices.

b. Excelsior does not intend to conduct an investigation of the source of petroleum in groundwater because the source(s) are not ongoing, the contamination is pre-existing, and the small quantity of organic compounds is considered a *de minimus* condition. In addition, it will be removed in the copper recovery process.

c. The solvent extraction-electrowinning (SX-EW) process mixes extracted, copper-bearing solutions (PLS) with a petroleum liquid (organic phase) as an essential part of the copper recovery process. Any petroleum compounds recovered from the wellfield in PLS, will be routed to the PLS pond and then to an extraction-stage mixer-settler. In the mixers, the PLS is thoroughly mixed with an active organic extractant in an organic liquid (similar to kerosene), forming a copper-organic complex. Petroleum compounds in the PLS will strongly partition into the organic phase and be separated from the aqueous phase in the settler. Each of six settlers has at least 1,800 square feet of area in which the organic phase is exposed to the atmosphere for volatilization of entrained BTEX compounds. The barren aqueous phase (raffinate) is routed to the raffinate pond for retention and further separation of the organic and aqueous phases. An oil skimmer in the raffinate pond will remove residual organics. The raffinate is pumped from the bottom of the raffinate pond, re-acidified, and recirculated in the wellfield. Although not intended for this purpose, the SX-EW process will be an effective way of removing any petroleum compounds from solution before it is re-injected into the aquifer. However, as discussed in part a of this answer, the extent of petroleum compounds in the wellfield is limited, and based on the characterization completed to date, Excelsior does not anticipate encountering LNAPL or significant concentrations of dissolved petroleum in the wellfield.

RESPONSE TO COMMENT 25

ADEQ COMMENT: *A.A.C. R18 -9-A202(A)(4) and (5)(a) – Section 5.4 indicates that groundwater beneath the project facility is impacted by volatile organic compounds and other petroleum hydrocarbons, and Section 6.2.7 indicates that the total concentration of organic compounds in the process solutions is expected to be approximately 30 to 50 mg/L total petroleum hydrocarbons (TPH) Please provide an evaluation of hydrocarbon impacts on the following:*

a. Impoundment HDPE-liners at the Johnson Camp Mine (JCM) during Stage 1, and proposed Gunnison project Stages 2 and 3.

RESPONSE:

Concentrations of TPH in the ponds on the order of 30 to 50 mg/L are anticipated from the organic liquid (diluent) used in sol vent extraction. These concentrations of TPH have proven to be compatible with HDPE lining systems in SX -EW operations in Arizona for the past four decades. The attached chemical resistance chart from GSE Environmental indicates that HDPE liners have satis factory resistance to petroleum at the temperatures expected at the site. At very high temperatures (140 °F) the liner may reflect some attack, depending on the concentration. Any issues regarding the existing liners at Johnson Camp ponds can be addressed in the Johnson Camp APP Amendment 2.

b. Equipment failure and maintenance problems for all mechanical equipment that will be associated with the permitted discharging facilities (well field and process/storage impoundments).

RESPONSE:

TPH concentrations in process solutions will have no impact on equipment failure and maintenance for mechanical equipment associated with the permitted discharging facilities. This equipment is designed to handle the acidic solutions with up to 100 mg/L TPH. Any additional contribution from leaking underground storage tank site (~6.8 µg/L) is considered insignificant compared to the TPH concentrations in the process solutions.

c. Chemical changes due to interactions between hydrocarbons known to be present at the site and process solutions (pregnant leach solution (PLS), raffinate, make-up water, and etc.).

RESPONSE:

The SX -EW process entrains and uses organic compounds as a normal part of the copper recovery. Should petroleum compounds be recovered from the wellfield in PLS, they will be routed to the PLS pond and then to an extraction stage mixer -settler. In the mixer, the PLS is mixed with an active organic extractant in an organic diluent (usually kerosene), forming a copper-organic complex. The barren aqueous phase (raf finate) is routed to the raffinate pond. An oil skimmer in the raffinate pond removes residual organics. The raffinate is pumped from the bottom of the raff pond, re -acidified, and recirculated in the wellfield. The organic solution goes to the electrowinn ing process for copper recovery. If petroleum compounds are recovered from the wellfield, they will be recovered in the aqueous/organic separation phase. Although not intended for this purpose, the SX -EW process will be an effective way of removing petrol eum compounds (if any) from water before it is re-injected into the aquifer.

The average total concentration of petroleum -related VOC compounds in the three wells apparently impacted by the underground storage tank releases associated with "The Thing" is 6.8 µg/L. Using the average screened interval of 237 feet and a prospective impact area of approximately 750 feet by 550 feet and a porosity of 3% (22 million gallons), the total VOC content is approximately 570 grams, 6.5 liters, or 1.7 gallons. Such a quantity of petroleum VOCs will have negligible impact on a solvent extraction system.

d. Compatibility with materials and structures associated with the well field operations (well/wellhead construction, pipelines, etc.).

RESPONSE:

The materials and s tructures associated with wellfield operations are designed to be compatible with hydrocarbon concentrations of 30 to 50 milligrams per liter. Low concentrations of additional petroleum hydrocarbons existing within the wellfield (resulting from the leaking underground storage tank site) are approximately four orders of magnitude lower in concentration and will have negligible impact on wellfield materials and structures.

Chemical Resistance Chart

GSE is the world's leading supplier of high quality, polyethylene geomembranes and geonets. GSE polyethylene geomembranes and geonets are resistant to a great number and combinations of chemicals. Note that the effect of chemicals on any material is influenced by a number of variable factors such as temperature, concentration, exposed area and duration. Many tests have been performed that use geomembranes and geonets and certain specific chemical mixtures. Naturally, however, every mixture of chemicals cannot be tested for, and various criteria may be used to judge performance. Reported performance ratings may not apply to all applications of a given material in the same chemical. Therefore, these ratings are offered as a guide only.

Medium	Concentration	Resistance at:	
		20° C (68° F)	60° C (140° F)
A			
Acetic acid	100%	S	L
Acetic acid	10%	S	S
Acetic acid anhydride	100%	S	L
Acetone	100%	L	L
Adipic acid	sat. sol.	S	S
Allyl alcohol	96%	S	S
Aluminum chloride	sat. sol.	S	S
Aluminum fluoride	sat. sol.	S	S
Aluminum sulfate	sat. sol.	S	S
Alum	sol.	S	S
Ammonia, aqueous	dil. sol.	S	S
Ammonia, gaseous dry	100%	S	S
Ammonia, liquid	100%	S	S
Ammonium chloride	sat. sol.	S	S
Ammonium fluoride	sol.	S	S
Ammonium nitratesat. sol.	S	S	
Ammonium sulfate	sat. sol.	S	S
Ammonium sulfide	sol.	S	S
Amyl acetate	100%	S	L
Amyl alcohol	100%	S	L
B			
Barium carbonate	sat. sol.	S	S
Barium chloride	sat. sol.	S	S
Barium hydroxide	sat. sol.	S	S
Barium sulfate	sat. sol.	S	S
Barium sulfide	sol.	S	S
Benzaldehyde	100%	S	L
Benzene	—	L	L
Benzoic acid	sat. sol.	S	S
Beer	—	S	S
Borax (sodium tetraborate)	sat. sol.	S	S
Boric acid	sat. sol.	S	S
Bromine, gaseous dry	100%	U	U
Bromine, liquid	100%	U	U
Butane, gaseous	100%	S	S
1-Butanol	100%	S	S
Butyric acid	100%	S	L
C			
Calcium carbonate	sat. sol.	S	S
Calcium chlorate	sat. sol.	S	S
Calcium chloride	sat. sol.	S	S
Calcium nitrate	sat. sol.	S	S
Calcium sulfate	sat. sol.	S	S
Calcium sulfide	dil. sol.	L	L
Carbon dioxide, gaseous dry	100%	S	S
Carbon disulfide	100%	L	U
Carbon monoxide	100%	S	S
Chloracetic acid	sol.	S	S
Carbon tetrachloride	100%	L	U
Chlorine, aqueous solution	sat. sol.	L	U
Chlorine, gaseous dry	100%	L	U
Chloroform	100%	U	U
Chromic acid	20%	S	L
Chromic acid	50%	S	L
Citric acid	sat. sol.	S	S
Copper chloride	sat. sol.	S	S
Copper nitrate	sat. sol.	S	S
Copper sulfate	sat. sol.	S	S
Cresylic acid	sat. sol.	L	—
Cyclohexanol	100%	S	S
Cyclohexanone	100%	S	L
D			
Decahydronaphthalene	100%	S	L
Dextrine	sol.	S	S
Diethyl ether	100%	L	—
Dioctylphthalate	100%	S	L
Dioxane	100%	S	S
E			
Ethanediol	100%	S	S
Ethanol	40%	S	L
Ethyl acetate	100%	S	U
Ethylene trichloride	100%	U	U
F			
Ferric chloride	sat. sol.	S	S
Ferric nitrate	sol.	S	S
Ferric sulfate	sat. sol.	S	S
Ferrous chloride	sat. sol.	S	S
Ferrous sulfate	sat. sol.	S	S
Fluorine, gaseous	100%	U	U
Fluorosilicic acid	40%	S	S
Formaldehyde	40%	S	S
Formic acid	50%	S	S
Formic acid	98-100%	S	S
Furfuryl alcohol	100%	S	L
G			
Gasoline	—	S	L
Glacial acetic acid	96%	S	L
Glucose	sat. sol.	S	S
Glycerine	100%	S	S
Glycol	sol	S	S
H			
Heptane	100%	S	U
Hydrobromic acid	50%	S	S
Hydrobromic acid	100%	S	S
Hydrochloric acid	10%	S	S
Hydrochloric acid	35%	S	S
Hydrocyanic acid	10%	S	S
Hydrofluoric acid	4%	S	S
Hydrofluoric acid	60%	S	L
Hydrogen	100%	S	S
Hydrogen peroxide	30%	S	L
Hydrogen peroxide	90%	S	U
Hydrogen sulfide, gaseous	100%	S	S
Lactic acid	100%	S	S
Lead acetate	sat. sol.	S	—
Magnesium carbonate	sat. sol.	S	S
Magnesium chloride	sat. sol.	S	S
Magnesium hydroxide	sat. sol.	S	S
Magnesium nitrate	sat. sol.	S	S
Maleic acid	sat. sol.	S	S
Mercuric chloride	sat. sol.	S	S
Mercuric cyanide	sat. sol.	S	S
Mercuric nitrate	sol.	S	S

Medium	Concentration	Resistance at: 20° C (68° F)	Resistance at: 60° C (140° F)
Mercury	100%	S	S
Methanol	100%	S	S
Methylene chloride	100%	L	—
Milk	—	S	S
Molasses	—	S	S
N			
Nickel chloride	sat. sol.	S	S
Nickel nitrate	sat. sol.	S	S
Nickel sulfate	sat. sol.	S	S
Nicotinic acid	dil. sol.	S	—
Nitric acid	25%	S	S
Nitric acid	50%	S	U
Nitric acid	75%	U	U
Nitric acid	100%	U	U
O			
Oils and Grease	—	S	L
Oleic acid	100%	S	L
Orthophosphoric acid	50%	S	S
Orthophosphoric acid	95%	S	L
Oxalic acid	sat. sol.	S	S
Oxygen	100%	S	L
Ozone	100%	L	U
P			
Petroleum (kerosene)	—	S	L
Phenol	sol	S	S
Phosphorus trichloride	100%	S	L
Photographic developer	cust. conc.	S	S
Picric acid	sat. sol.	S	—
Potassium bicarbonate	sat. sol.	S	S
Potassium bisulfide	sol.	S	S
Potassium bromate	sat. sol.	S	S
Potassium bromide	sat. sol.	S	S
Potassium carbonate	sat. sol.	S	S
Potassium chlorate	sat. sol.	S	S
Potassium chloride	sat. sol.	S	S
Potassium chromate	sat. sol.	S	S
Potassium cyanide	sol.	S	S
Potassium dichromate	sat. sol.	S	S
Potassium ferricyanide	sat. sol.	S	S
Potassium ferrocyanide	sat. sol.	S	S
Potassium fluorid	sat. sol.	S	S
Potassium hydroxide	10%	S	S
Potassium hydroxide	sol.	S	S
Potassium hypochlorite	sol.	S	L
Potassium nitrate	sat. sol.	S	S
Potassium orthophosphate	sat. sol.	S	S
Potassium perchlorate	sat. sol.	S	S
Potassium permanganate	20%	S	S
Potassium persulfate	sat. sol.	S	S
Potassium sulfate	sat. sol.	S	S
Potassium sulfite	sol.	S	S
Propionic acid	50%	S	S
Propionic acid	100%	S	L
Pyridine	100%	S	L
Q			
Quinol (Hydroquinone)	sat. sol.	S	S
S			
Salicylic acid	sat. sol.	S	S
Silver acetate	sat. sol.	S	S
Silver cyanide	sat. sol.	S	S
Silver nitrate	sat. sol.	S	S
Sodium benzoate	sat. sol.	S	S
Sodium bicarbonate	sat. sol.	S	S
Sodium biphosphate	sat. sol.	S	S
Sodium bisulfite	sol.	S	S
Sodium bromide	sat. sol.	S	S
Sodium carbonate	sat. sol.	S	S
Sodium chlorate	sat. sol.	S	S
Sodium chloride	sat. sol.	S	S
Sodium cyanide	sat. sol.	S	S
Sodium ferricyanide	sat. sol.	S	S
Sodium ferrocyanide	sat. sol.	S	S
Sodium fluoride	sat. sol.	S	S
Sodium hydroxide	40%	S	S
Sodium hydroxide	sat. sol.	S	S
Sodium hypochlorite	15% active chlorine	S	S
Sodium nitrate	sat. sol.	S	S
Sodium nitrite	sat. sol.	S	S
Sodium orthophosphate	sat. sol.	S	S
Sodium sulfate	sat. sol.	S	S
Sodium sulfide	sat. sol.	S	S
Sulfur dioxide, dry	100%	S	S
Sulfur trioxide	100%	U	U
Sulfuric acid	10%	S	S
Sulfuric acid	50%	S	S
Sulfuric acid	98%	S	U
Sulfuric acid	fuming	U	U
Sulfurous acid	30%	S	S
T			
Tannic acid	sol.	S	S
Tartaric acid	sol.	S	S
Thionyl chloride	100%	L	U
Toluene	100%	L	U
Triethylamine	sol.	S	L
U			
Urea	sol.	S	S
Urine	—	S	S
W			
Water	—	S	S
Wine vinegar	—	S	S
Wines and liquors	—	S	S
X			
Xylenes	100%	L	U
Y			
Yeast	sol.	S	S
Z			
Zinc chloride	sat. sol.	S	S
Zinc (II) chloride	sat. sol.	S	S
Zinc (IV) chloride	sat. sol.	S	S
Zinc oxide	sat. sol.	S	S
Zinc sulfate	sat. sol.	S	S

Specific immersion testing should be undertaken to ascertain the suitability
of chemicals not listed above with reference to special requirements.

Notes:
(S) Satisfactory: Liner material is resistant to the given reagent at the given concentration and temperature. No mechanical or chemical degradation is observed.
(L) Limited Application Possible: Liner material may reflect some attack. Factors such as concentration, pressure and temperature directly affect liner performance against the given media. Application, however, is possible under less severe conditions, e.g. lower concentration, secondary containment, additional liner protections, etc.
(U) Unsatisfactory: Liner material is not resistant to the given reagent at the given concentration and temperature. Mechanical and/or chemical degradation is observed.
(-) Not tested
sat. sol. = Saturated aqueous solution, prepared at 20°C (68°F)
sol. = aqueous solution with concentration above 10% but below saturation level
dil. sol. = diluted aqueous solution with concentration below 10%
cust. conc. = customary service concentration

GSE is a leading manufacturer and marketer of geosynthetic lining products and services. We've built a reputation of reliability through our dedication to providing consistency of product, price and protection to our global customers.

Our commitment to innovation, our focus on quality and our industry expertise allow us the flexibility to collaborate with our clients to develop a custom, purpose-fit solution.

GSE ENVIRONMENTAL™

[DURABILITY RUNS DEEP] For more information on this product and others, please visit us at GSEworld.com, call 800.435.2008 or contact your local sales office.

North America 800.435.2008 | Europe & Africa 49.40.767420 | Asia Pacific 66.2.937.0091 | South America 56.2.595.4200 | Middle East 20.23828.8888

TECHNICAL NOTE

Chemical Resistance for Geomembrane Products

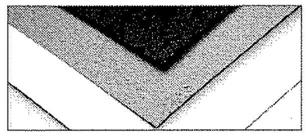
GSE geomembranes are made of high quality, virgin polyethylene which demonstrates excellent chemical resistance. GSE polyethylene geomembranes are resistant to a great number and combinations of chemicals. It is this property of (HDPE) high density polyethylene geomembranes that makes it the lining material of choice.

In order to gauge the durability of a material in contact with a chemical mixture, testing per ASTM D5747 is required in which the material is exposed to the chemical environment in question. Chemical resistance testing is a very large and complex topic because of two factors. First, the number of specific media is virtually endless and second, there are many criteria such as tensile strength, hardness, etc. that may be used to assess a material's resistance to degradation.

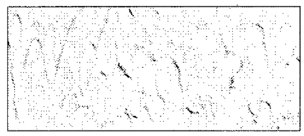
The chemical resistance of polyethylene has been investigated by many people over the past few decades. We are able to draw from that work when making statements about the chemical resistance of today's polyethylene geomembranes. In addition to that, many tests have been performed that specifically use geomembranes and certain chemical mixtures. Naturally, however, every mixture of chemicals cannot be tested for. As a result of these factors, GSE published a chemical resistance chart, demonstrating general guidelines.

Polyethylene is, for practical purposes, considered impermeable. Be aware, however, that all materials are permeable to some extent. Permeability varies with concentration, temperature, pressure and type of permeant. The rates of permeation are usually so low, however, that they are insignificant. As a point of reference, polyethylene is commonly used for packaging of several types of materials. These include gasoline, motor oil, household cleaners (i.e. bleach), muratic acid, pesticides, insecticides, fungicides, and other highly concentrated chemicals. Also, you should be aware that there are some chemicals which may be absorbed by the material but only when present at very high concentrations. These include halogenated and/or aromatic hydrocarbons at greater than 50%; their absorption results in swelling and slight changes in physical properties such as increased tensile elongations. This includes many types of fuels and oils. Recognize that this action, however, does not affect the liner's ability to act as a barrier for the material it is containing.

Since polyethylene is a petroleum product, it can absorb other petroleum products. Like a sponge, the material becomes slightly thicker and more flexible but does not produce a hole or void. However, unlike a sponge, this absorption is not immediate. It takes a much longer time for a polyethylene liner to swell than it does for a sponge. The exact time it takes for swelling to occur depends on the particular constituents and concentrations of the contained media. However, a hole would not be produced. Also, this absorption is reversible and the material will essentially return to it's original state when the chemical is no longer in contact with the liner.



GSE Geomembranes



GSE Textured HPDE

GSE GEOMEMBRANES

An HDPE geomembrane used in applications that require excellent chemical resistance and endurance properties

RESPONSE TO COMMENT 52

ADEQ COMMENT: *Presence of hydrocarbons in the groundwater has been documented in the application. Arizona Revised Statutes (A.R.S.) 49-243(B)(3) states that "no pollutants discharged will further degrade at the applicable point of compliance the quality of any aquifer that at time of issuance of the permit violates the aquifer quality standard for that pollutant." Please provide an evaluation that capture and reinjection of hydrocarbon pollutants through the In-Situ process in other parts of the aquifer does not violate requirements of other programs such as the leaking underground storage tank (LUST) program or other applicable ADEQ programs.*

RESPONSE:

Based on our model of the occurrences of hydrocarbons at the site (as discussed under the response to comment 3, there are two sources:

1. Drilling fluids, including diesel or some other petroleum product in CS-10 and CS-14. LNAPL, benzene, toluene, ethylbenzene, xylenes, and polycyclic aromatic hydrocarbons (PAHs) are present in these coreholes. The extent of hydrocarbons associated with source #1 is in the immediate area of the two boreholes, for the reasons outlined in the response to comment 3.
2. Gasoline compounds (primarily benzene, toluene, and 1,2 dichloroethane—a lead scavenger) from leaking underground storage tanks at the "Thing" (ADEQ LUST ID 4387). ADEQ closed the site in May 2005.

To the extent that hydrocarbon pollutants are present in the aquifer, they may be captured through the in-situ process. However, this will not violate requirements of other ADEQ programs. If petroleum from either of these sources is recovered with PLS, it would be captured through the SX-EW process, as described in the response to comment 3c. These hydrocarbons will not be reinjected. Although the SX-EW process is not intended as a remediation measure, it would serve as an effective way of removing any petroleum compounds from raffinate before it is re-injected into the aquifer.